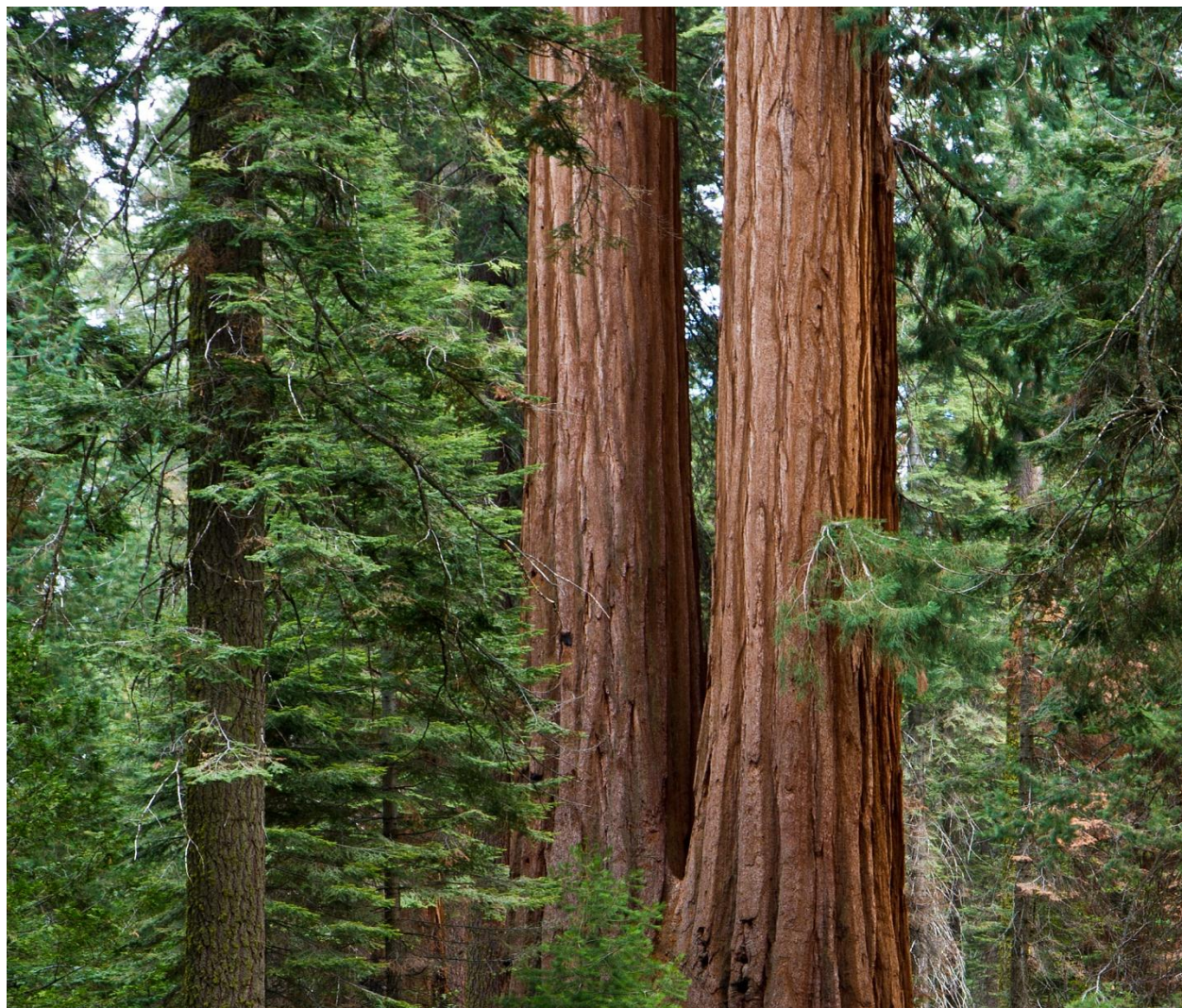




A Natural Resource Condition Assessment for Sequoia and Kings Canyon National Parks

Appendix 5 – Soils

Natural Resource Report NPS/SEKI/ NRR—2013/665.5



ON THE COVER

Giant Forest, Sequoia National Park
Photography by: Brent Paull

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Natural Resource Report NPS/SEKI/ NRR—2013/665.5

Joel Despain
Sequoia and Kings Canyon National Parks
47050 Generals Highway
Three Rivers, CA 93271-9700

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U.S. Department of the Interior
National Park Service
Natural Resource Stewardship and Science
Fort Collins, Colorado

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This document contains subject matter expert interpretation of the data. The authors of this document are responsible for the technical accuracy of the information provided. The parks refrained from providing substantive administrative review to encourage the experts to offer their opinions and ideas on management implications based on their assessments of conditions. Some authors accepted the offer to cross the science/management divide while others preferred to stay firmly grounded in the presentation of only science-based results. While the authors' interpretations of the data and ideas/opinions on management implications were desired, the results and opinions provided do not represent the policies or positions of the parks, the NPS, or the U.S. Government.

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Contents

	Page
Summary of Existing Information	1
Huntington Mapping.....	1
New Park Soils Map	4
Literature Cited	5

Tables and Figures

	Page
Table 1. Standard Soil mapping orders.	1
Table 2. Soil units of the Huntington General Soil map, 1987.	2
Figure 1. Current extent of SEKI soils map (Huntington and Akeson 1987). Soil units are described in the Huntington report. A comprehensive map of the entire Parks area will be started in 2012.	3

Summary of Existing Information

Soil mapping and information within Sequoia and Kings Canyon National Parks is largely lacking. One significant soil mapping project (19,900 hectares) was completed in 1987 by Gordon L. Huntington of UC Davis (Huntington and Akeson 1987). This was an 4th Order survey in the Middle and Marble Forks of the Kaweah River including the southerly side of Ash Peaks Ridge, Giant Forest and much of the headwaters of the Marble Fork (Figure 1). From this, both a *General Soil Map* and a *Reconnaissance Soil Map* were produced, as well as a 1st Order survey of sites used for acid rain precipitation studies conducted at that time at Emerald Lake, Log Meadow, and Elk Creek (Table 1).

A new cooperative effort between the parks, the NPS Geologic Resources Division (NPS-GRD), and the Natural Resources Conservation Service (NRCS) is being developed to create a complete soils map for the parks. Field work on this project will begin in Fiscal Year 2012.

Table 1. Standard Soil mapping orders.

Soil Survey Level	Field Procedures	Minimum Size Delineation (hectares)	Likely Map Units	Approximate scale for publication
1 st Order: Very intensive and small -- a specific building site or research plot	Soils in all delineations are identified by transecting or traversing; soil boundaries are observed along their entire length.	less than 1	Mostly consociations, some complexes, miscellaneous area	1:15,840
2 nd Order: Intensive -- used for urban planning or agriculture	The soils in each delineation are identified by field observations and by remotely sensed data. Boundaries are verified at closely spaced intervals.	0.6 to 4	Consociations, complexes; few associations and undifferentiated groups	1: 12,000 to 1: 31,680
3 rd Order: Extensive -- community planning and range lands	Soil boundaries plotted by observation and interpretation of remotely sensed data. Soil boundaries are verified by traversing representative areas and by some transects.	1.6 to 16	Mostly associations or complexes, some consociations and undifferentiated groups	1:20,000 to 1:63,360
4 th Order: Extensive -- general soil information for broad statements concerning land use potential and general land management	Soil boundaries plotted by interpretation of remotely sensed data. Boundaries are verified by traversing representative areas and by some transects.	16 to 252	Mostly associations; some complexes, consociations and undifferentiated groups	1:63,360 to 1 to 250,000
5 th Order: Very extensive -- regional planning, selections of areas for more intensive study	The soil patterns and composition of map units are determined by mapping representative ideas and like areas by interpretation of remotely sensed data. Soils verified by occasional onsite investigation or by traversing.	252 to 4000	Associations; some consociations and undifferentiated groups	1: 250,000 to 1: 1,000,000

Huntington Mapping

Huntington and Akeson (1987) described the overall mapped area in their report: "... consists of a mantle of soil overlying variably weathered rock at depths ranging from a few centimeters to several meters. A substantial portion, particularly in the alpine zone lacks this mantle and the land surface consists of variably fractured rock."

On the *General Soils* map, Huntington and Akeson (1987) laid out the basic dominant soil types of the study area. The units for this mapping were large and broad with general soil descriptions. He divided the area into three zones – foothills, middle mountain and high mountain. Within the foothills he identified six soil units and four rock or mixed rock and soil units, in the middle mountain three soil units and two rock units and in the high mountain three soil units and one rock, as well as other miscellaneous areas such as talus, lakes, and glacial rubbleland (Table 2).

Table 2. Soil units of the Huntington General Soil map, 1987.

Unit	Location	Percentage of the area (19,900 hectares)
Ochrepts, thermic	Foothills	0.6
Orthods, cryic	High Mountain	0.7
Orthents, thermic	Foothills	1.4
Orthents, cryic	High Mountain	0.7
Umbrepts, mesic	Middle Mountain	20.9
Umbrepts, frigid	Middle Mountain	0.2
Umbrepts, cryic	High Mountain	5.9
Umbrepts-Humults, mesic	Middle Mountain	3.5
Xerafls, thermic	Foothills	8.6
Xerafls, mesic	Foothills	0.7
Xerolls, thermic	Foothills	3.7
Xerolls, mesic	Foothills	12.2

The 4th Order *Reconnaissance Map* shows the dominant soil types of the area with many consociations or associations of the soil taxonomy. At this scale of mapping no one unit consists entirely of one soil taxon. For this map, Huntington developed 119 total map units including soils and non-soil features such as rock and lakes. Ninety eight pages of the report are dedicated to describing the 119 units on the *Reconnaissance Map*.

For the highly detailed 1st Order soil mapping, 190 total hectares were mapped in three locations in the foothills (Elk Creek), middle mountain (Log Meadow) and high mountain (Emerald Lake). Huntington identified 16 map units for the 10 hectare Elk Creek area; 37 units from 60 hectare Log Meadow, and 30 from the 120 hectare Emerald Lake watershed. The final 42 pages of the report describe these soil units.

The Huntington report also includes reference pedons (Appendix I); 24 physical and chemical soil analysis results for horizon samples from the reference pedons (Appendix II); a glossary of terms (Appendix III), a map erratum (Appendix IV), and the soils maps themselves. The General Soils map is within the body of the text while the Reconnaissance and Order 1 Highly Detailed maps are included in a separate packet.

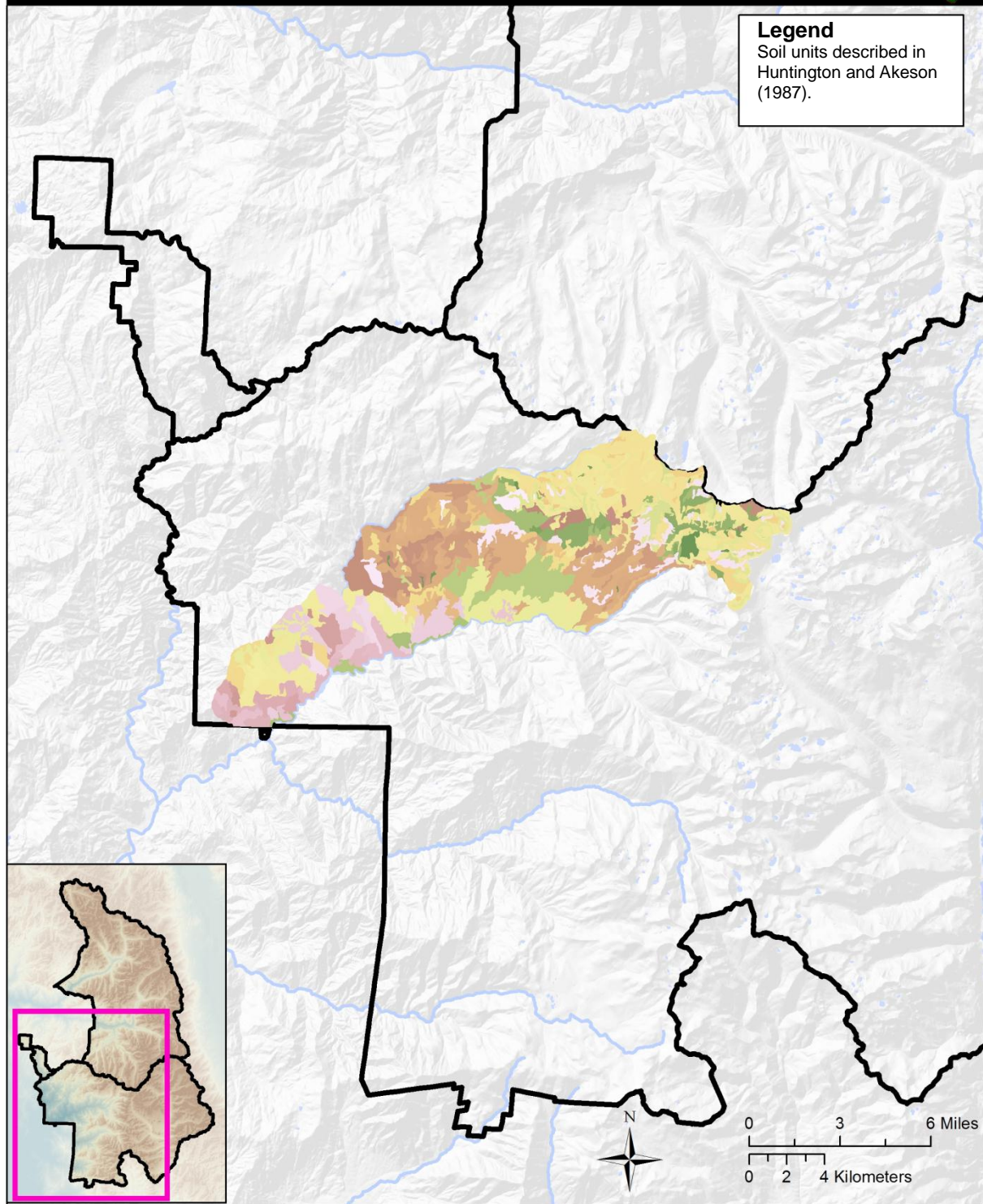


Figure 1. Current extent of SEKI soils map (Huntington and Akeson 1987). Soil units are described in the Huntington report. A comprehensive map of the entire Parks area will be started in 2012.

New Park Soils Map

The parks are working with the NPS-GRD and California state NRCS in planning for comprehensive soils maps for the parks covering all 349,527 hectares (863,700 acres). Field work, which is expected to take up to 5 years, will start in FY 2012.

The parks intend to map most of the Sequoia and Kings Canyon as 3rd Order, but a number of areas have been identified to complete to 2nd Order mapping. Unlike the Huntington work no 1st Order or 4th Order mapping will take place. Second Order areas to be mapped include Sequoia National Park watersheds and areas upslope of existing sequoia groves, metamorphic geology areas such as the Sequoia and Goddard pendants and the Bench Lake area, and an elevational transect of sites from Ash Mountain (or other low elevation location) to Mt Whitney (or other high elevation location). Further 2nd Order mapping will take place in specific park areas including commercial developments, campgrounds, research and monitoring areas, and sewage treatment spray fields.

Deliverables will be quite different from many earlier soil mapping projects. Ecological Site Surveys that characterize plant and animals communities and their relationships to soils are now standard for the NPS. Other products will include soil moisture and temperature data, working with a greater soil climate network composed of multiple parks, soil carbon distribution, and wetland type delineation (peat vs. fen). Products will be delivered both as paper maps and GIS databases and can include unique products upon request from the park. Deliverables would likely start being finalized in approximately 5 years with all products in place with 7 years.

Literature Cited

Huntington, Gordon L. and Mark A. Akeson. 1987. Soil Resource Inventory of Sequoia National Park, Central Part, California, Project Report Department of Land, Air and Water Resources, University of California, Davis and the National Park Service, US Department of the Interior, 170 pps.

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Natural Resource Stewardship and Science

1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

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